

***Dentostomella tamimi* sp. n. (Nematoda: Heteroxynematidae) from the Spiny Mouse, *Acomys dimidiatus*, in Saudi Arabia**

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ABSTRACT: *Dentostomella tamimi* sp. n. was collected from the anterior third of the small intestine of the spiny mouse, *Acomys dimidiatus* (Cretzschmar, 1826), trapped at Hotut Beni Tamim and at Heet, Riyadh Province, Saudi Arabia. The worms are long and slender and have the largest cervical inflation in the genus *Dentostomella*. On top of this inflation, there are 4 large submedian papillae, 2 on either side, together with 2 lateral amphids, on either side between the submedian papillae. Three pairs of small, hardly discernible papillae surround the small, circular mouth opening, 1 pair dorsally and 2 pairs ventrally. The mouth opens into a shallow, triradiate buccal cavity surrounded by 3 esophageal sectors. Each sector has 2 small lateral teeth and a single, large median tooth. Females are 21.0–25.0 (22.5) mm long, 0.49–0.55 (0.52) mm wide, at the region of the vulva, which is located at about the middle of the body. Males are 14.0–16.0 (15.4) mm long and of a maximum width of 0.34–0.38 (0.354) mm. The male has a median rugose and fleshy bursa without supporting rays, and its tail bears 7 caudal papillae, 1 pair preanal, 1 pair adanal, an unpaired papilla just under the cloaca, and 1 pair subanal. The single male spicule is lightly sclerotized, with an irregular depression on its anterior end; its distal tip is bifid in ventral view. The tip of the tail in both sexes has an arrowhead appearance dorsoventrally and is more pronounced in males. This is due to the presence of 2 small, ventrolateral protuberances containing the phasmids.

KEY WORDS: *Dentostomella tamimi* sp. n., *Acomys dimidiatus*, Heteroxynematidae, oxyurid nematodes, rodent, spiny mouse.

Several members of the genus *Dentostomella* Schulz and Krepkogorskaja, 1932, were described from various species of rodents including spiny mice of the genus *Acomys* Geoffroy, 1838 (Schulz and Krepkogorskaja, 1932; Myers, 1961; Chitwood, 1963; Quentin, 1975). During parasitological assessment of the indigenous fauna of Hotut Beni Tamim, Riyadh Province, Saudi Arabia, prior to the establishment of a National Park in the region, 3 female *Dentostomella* sp. were recovered from the duodenum of the spiny mouse, *Acomys dimidiatus* (Cretzschmar). Later, many males and females of the same nematode were recovered from the anterior third of the small intestine of the same host trapped at Heet, Riyadh Province. These nematodes belong to a hitherto undescribed species in the genus *Dentostomella*, which is described in the present study.

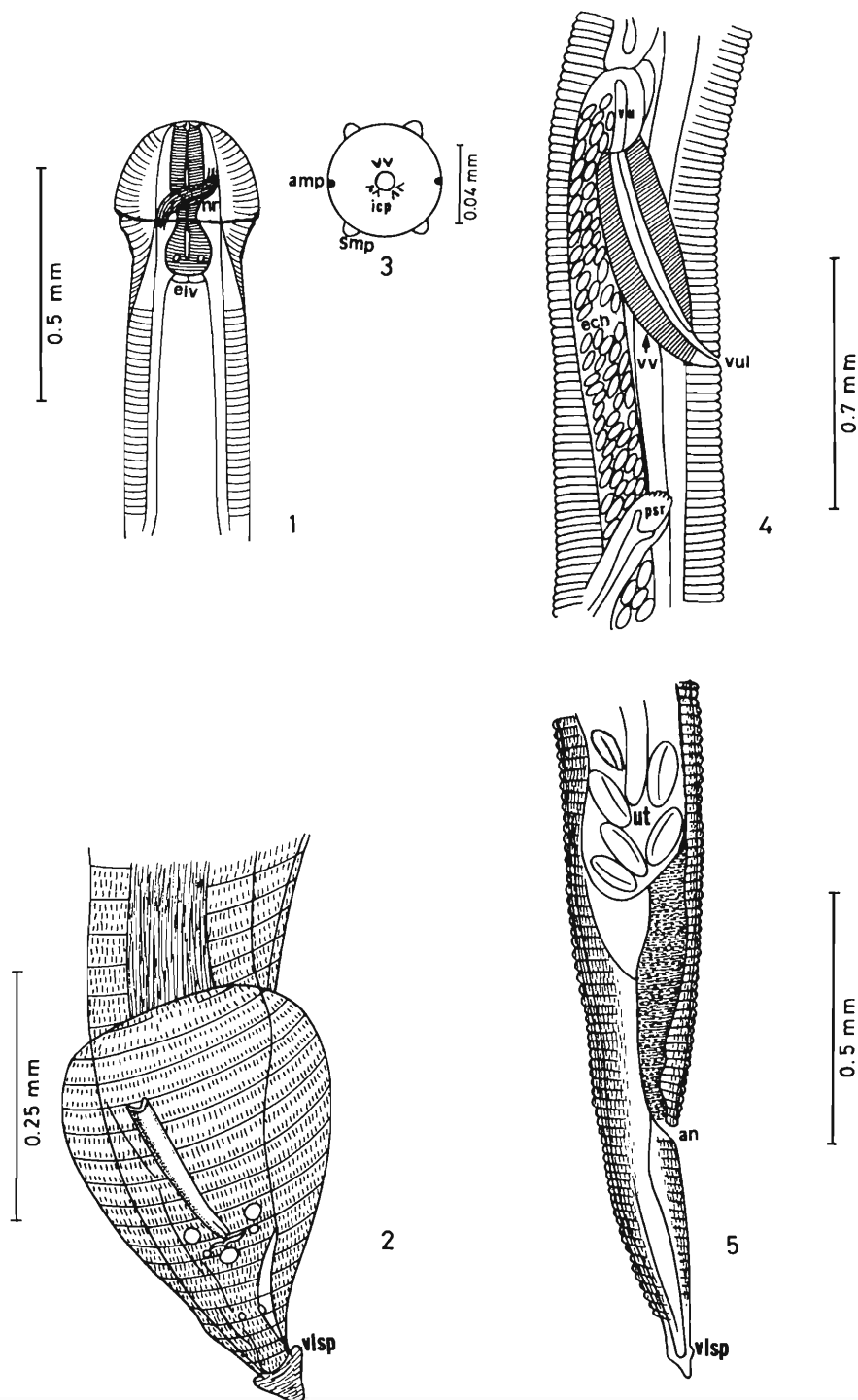
Materials and Methods

Prior to the establishment of a National Park for the endangered Nubian ibex, *Capra ibex nubiana* Cuvier, by the National Commission for Wildlife Conservation and Development (NCWCD) at Hotut Beni Tamim, a mountainous region some 300 km southeast of Riyadh, the capital of Saudi Arabia, wild animals indigenous to the region were live-trapped for the assessment of the natural fauna of the region. Six spiny mice, *A. dimidiatus*, were obtained from NCWCD for parasitological investigations. Later wild rodents were also

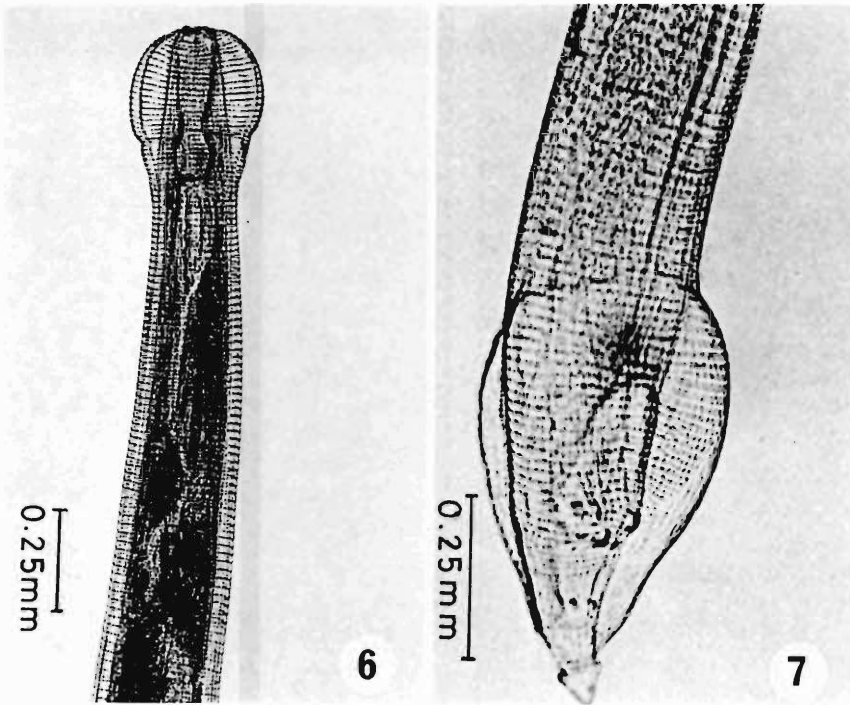
live-trapped at Heet, another mountainous area, 30 km southeast of Riyadh. Trapped animals were identified by reference to Harrison (1972) and to Osborn and Helmy (1980). They were sexed, aged, and weighed, and their bodies and tails were measured. They were then individually housed into laboratory mouse boxes provided with sawdust for bedding. Food (laboratory mouse chow supplemented with lettuce and carrots) and water were provided ad libitum.

Animals were killed by cervical dislocation and were opened by longitudinal incision along the midventral line from the top of the rib cage to the pubis. The heart and lungs were removed into a petri dish containing normal saline (0.9% NaCl). The entire intestinal tract was then removed, measured, and cut into 3-cm segments. Each segment was separately placed into a petri dish containing normal saline, opened, and examined under a binocular dissecting microscope, and the number of nematodes per individual segment was recorded. Live nematodes were examined before they were killed in hot 70% alcohol. Then they were relaxed overnight in the refrigerator. Nematodes were cleared for study in temporary wet mounts in phenol-alcohol (80 parts melted phenol in 20 parts absolute alcohol). Some males were mounted in lactophenol or cleared in glycerine to prevent overclearing of the spicules. En face views of several specimens were mounted and studied in glycerine jelly.

The nematodes were identified by reference to Skrjabin et al. (1960), Yamaguti (1961), and Petter and Quentin (1976) and to descriptions and redescrptions of various *Dentostomella* species (Schulz and Krepkogorskaja, 1932; Myers, 1961; Chitwood, 1963; Pillitt and Wightman, 1979; Ashour and Lewis, 1982; Greve, 1985). Measurements were made with a calibrated ocular micrometer, drawings with an attached Zeiss cam-



Figures 1–5. Line drawings of male and female *Dentostomella tamimi* sp. n. 1. Ventral side of anterior end of male. 2. Ventral side of tail of male. 3. En face view of male. 4. Vulvar region of female. 5. Ventral side of tail of female. amp, amphid; an, anus; ech, egg chamber; eiv, esophageo-intestinal valve; icp, inner circle papillae; nr, nerve ring; psr, post vulvar seminal receptacle; smp, submedian papillae; ut, uterus; vlsp, ventrolateral sub-terminal protuberances containing the phasmids; vu, vagina uterina; vv, vagina vera.



Figures 6, 7. Photomicrographs of male *Dentostomella tamimi* sp. n. 6. Anterior end of male. 7. Tail of male.

Table 1. Measurements (in micrometers) of *Dentostomella tamimi* sp. n., *D. kuntzi*, *D. translucida*, *D. grundmanni*, and *D. legerae*.

Item	<i>D. tamimi</i> sp. n.		<i>D. kuntzi</i> Myers, 1961		<i>D. kuntzi</i> of Ashour and Lewis, 1982	
	Male	Female	Male	Female	Male	Female
Length	14–16	21–25	9–11.8	10.3–15.6	6.9–13.3	15.9–23.9
Maximum width	0.34–0.38	0.49–0.55	0.13–0.15	0.3–0.4	0.13–0.31	0.21–0.44
Width of cervical inflation	0.29–0.35	0.31–0.41	0.16*	—	0.19–0.26	0.2–0.29
Esophagus length	0.33–0.48	0.38–0.58	0.28*	0.22–0.44	0.24–0.33	0.27–0.41
Excretory pore from anterior end	1.11–1.28	1.66–1.7	1.8–2.4†		2.64	2.88
Nerve ring from anterior end	0.15–0.19	0.15–0.19	—	—	0.16–0.2	0.18–0.26
Bursa						
Length	0.6–0.76	—	0.48	—	0.31	—
Width	0.35–0.37	—	0.258	—	0.16	—
Spicule length	0.16–0.17	—	0.18–0.19	—	0.12–0.20	—
Vulva from anterior end	—	9.5–11.4	—	6–7.2	—	4.13–10.73
Vagina vera length	—	0.65–1.03	—	0.7	—	0.6
Egg						
Length	—	0.14–0.16	—	0.12–0.13	—	0.129–0.144
Width	—	0.05–0.07	—	0.03–0.04	—	0.048–0.076
Tail length	0.206–0.424	0.342–0.768	0.232	0.83–0.85	0.18–0.24	0.38–0.58

* Measured during examination of paratypes in present study.

† Authors did not differentiate between male and female.

era lucida, and photomicrographs with an attached Nikon camera.

Results

The only rodent species trapped from the rock crevices in both localities was the spiny mouse, *A. dimidiatus*. Six spiny mice (3 males and 3 females) trapped at Hotut Beni Tamim were first assessed for gastrointestinal helminths and each of the 3 males yielded a single female *Dentostomella* sp. from the anteriormost segment of the small intestine, but the female mice were free of infection. Thereafter, 75 spiny mice (40 males and 35 females) were trapped at Heet. These gave a total of 85 (56 males and 29 females) specimens of the same *Dentostomella* sp. Of these, 77 were from the anteriormost segment of the small intestine and only 8 from other parts of the jejunum. Moreover, far more male mice (85%) were found infected with the nematode than females (20%).

All of the worms collected belonged to a *Dentostomella* species that is different from any other in the genus but is somewhat more related to *Dentostomella kuntzi* Myers, 1961, than any other species. Hence, paratypes of *D. kuntzi* deposited at the United States National Museum, Maryland (USNM Helm. Coll. No. 56804) were requested and compared to the present species.

This showed that the present worms are distinct and, hence, belong to an unnamed species, which is described below. All measurements are in millimeters, with means in parentheses.

Dentostomella tamimi sp. n.
(Figs. 1–7; Tables 1, 2)

DESCRIPTION: Worms long and slender. Cuticle thick, transparent, coarsely and transversely striated. Striations wide, each with fine longitudinal ridges or annules. Cervical cuticle inflated, forming large, transversely striated cervical vesicle. Cervical vesicle tapering downward and extending to level of junction of esophagus with intestine, constricted at level of bulbar part of esophagus, appearing as if they were 2 instead of 1 vesicles. Worm body inside vesicle thinner than outside, tapering anteriorly (Figs. 1, 6). Cephalic end with 4 prominent submedian papillae, with 2 lateral amphids in between; all on a circle surrounding the mouth. Mouth circular, centrally located; surrounded with 3 pairs of small, hardly discernible papillae, 1 pair dorsal, 2 pairs ventrolateral (Fig. 3). Lips absent; mouth opens into triradiate, shallow buccal cavity bordered by 3 esophageal sectors; each with 3 unequal teeth; 2 small lateral, 1 large conical median tooth. Esophagus short, thick, muscular, as wide as in-

Table 1. Continued.

<i>D. translucida</i> Schulz and Krepko- goroskaja, 1932		<i>D. translucida</i> of Pilitt and Wightman, 1979		<i>D. grundmani</i> Chitwood, 1963		<i>D. legerae</i> Quentin, 1975	
Male	Female	Male	Female	Male	Female	Male	Female
14.2–18.3	21.8–40.6	6.14–13.14	9.63–31	4–8	13.4–17.8	7.5	21
0.664	1.08–1.36	0.374–0.53	0.375–0.996	0.18–0.33	0.6–0.8	0.3	0.8
—	—	—	—	—	—	—	—
0.33–0.35	0.4–0.44	0.294–0.319	0.344–0.432	0.23	0.33–0.35	0.27	0.31
—	3.2–5.4	2.41–3.49	1.93–4.04	—	3.7–4.1	2.32	3.6
—	0.28	0.147–0.189	0.176–0.223	0.18	0.2	0.2†	
0.796–0.83	—	0.498–0.726	—	—	—	—	—
—	—	—	—	—	—	—	—
0.329–0.381	—	0.257–0.323	—	0.26	—	0.2–0.27	—
—	9.8–17.3	—	4.48–12.87	—	7.5–9.1	—	10
—	0.94–1.16	—	0.95	—	0.78	—	—
—	0.12–0.14	—	0.097–0.134	—	0.13–0.14	—	0.145
—	0.04–0.06	—	0.04–0.05	—	0.04–0.05	—	—
—	0.84–0.86	0.332–0.457	0.432–0.714	0.515	0.8	0.3–0.35	0.39

testine, constricted just below nerve ring (Fig. 1); posterior part bulbar, without armaments; esophageo-intestinal valve present (Figs. 1, 6).

FEMALE ($N = 29$): Length 21.0–25.0 (22.5), maximum width 0.49–0.55 (0.52) at vulvar region about middle of body (Fig. 4). Transverse cuticular striations 0.023 apart, cervical inflation 0.32–0.41 (0.363) wide. Esophagus 0.38–0.58 (0.51) long, esophageal bulb 0.09–0.14 (0.12) wide. Nerve ring and excretory pore 0.145–0.189 (0.175) and 1.66–1.70 (1.68), respectively, from anterior extremity. Vulva a transverse slit 9.5–11.4 (10.8) from anterior end, opening into thick-walled, muscular, anteriorly directed vagina vera 0.465–1.025 (0.85) in length, 0.28 maximum width (Fig. 4, Table 1). Vagina uterina anteriorly directed in part, then curves and continues posteriorly as narrow uterine tube that widens posteriorly as egg chamber (Fig. 4). Egg chamber joined by 2 posteriorly directed uteri confined to posterior part of body. Both turn forward to join egg chamber; one just above the anus and the other farther above (Figs. 4, 5). Both ovaries anterior to vulva; 2 small seminal receptacles occur between ovaries and oviduct, 1 pre- and the other postvulvar (Fig. 4). Anus crescent-shaped slit 0.342–0.768 (0.532) from arrowhead tail tip. Terminal part of tail with 2 small ventrolateral, subterminally situated, protuberances containing the phasmids; giving tail tip an arrowhead appearance in ventral view (Fig. 5). Egg oval, asymmetrical 0.14–0.16 (0.152) long, 0.05–0.07 (0.065) wide (Fig. 4, Table 1).

MALE ($N = 56$): Length 14.0–16.0 (15.4), maximum width 0.34–0.38 (0.345). Transverse striations 0.017 apart. Esophagus 0.33–0.48 (0.41), esophageal bulb 0.06–0.09 (0.078) wide. Nerve ring and excretory pore 0.150–0.186 (0.169) and 1.11–1.28 (1.195), respectively, from anterior end (Table 1). Tail with oblong, fleshy bursa devoid of supporting rays, 0.60–0.67 (0.645) long, 0.35–0.37 (0.362) maximum width, rugose ventrally due to transverse striae and plaquelike markings. Tail short, slightly curved ventrad, with 2 small ventrolateral, subterminal protuberances containing the phasmids (more pronounced than in females), giving tail tip arrowhead appearance in ventral view (Figs. 2, 7). Spicule single 0.16–0.17 (0.162), slightly sclerotized; upper end rounded, with uneven depression; distal tip bifid ventrally (Fig. 2). Caudal papillae 7, 1 pair preanal, 1 pair adanal, a large, unpaired papilla just below cloaca, 1 pair postanal midway between cloaca and tail tip (Figs. 2, 7).

TYPE HOST: *Acomys dimidiatus* (Cretzschmar, 1826).

LOCATION: Upper third of small intestine.

TYPE LOCALITY: Heet, Riyadh Province, Saudi Arabia.

OTHER LOCALITIES: Hotut Beni Tamim, Riyadh Province, Saudi Arabia.

SPECIMENS DEPOSITED: Holotype ♂ and allotype ♀: USNM Helminthological Collection No. 81046; Paratypes: author's collection, Zoology, College of Science, King Saud University, Riyadh, Saudi Arabia.

ETYMOLOGY: The specific name *tamimi* is after the name of the tribe Beni Tamim, which inhabits Hotut Beni Tamim, from which the first spiny mice infected with the worm were collected.

Discussion

The genus *Dentostomella* was established by Schulz and Krepkogorskaja (1932) to include the oxyurid nematode, *Dentostomella translucida*, that they found in the large intestine of the great gerbil, *Rhombomys opimus* Lichtenstine in Kazakhstan, U.S.S.R. It was later found to be very common in great gerbils in the plateau and desert regions of the Central Asian republics of Kazakhstan and Uzbekistan (Schulz and Landa, 1935; Shleikher and Samsonova, 1954) and was more recently proven to have a wider host range among cricetid rodents (Chitwood, 1963; Danzan, 1978; Wightman et al., 1978; Piliitt and Wightman, 1979; Greve, 1985). Other species in the genus include *Dentostomella kuntzi* Myers, 1961, *Dentostomella grundmani* Chitwood, 1963, and *Dentostomella legerae* Quentin, 1975, which were described from the spiny mice, *Acomys russatus* (Wagner) and *Acomys cahirinus* (Desmarest), from the chipmunk, *Eutamias quadrivittatus* (Say), and from the large North African gerbil, *Gerbillus campestris* Levaillant, respectively (Myers, 1961; Chitwood, 1963; Quentin, 1975). Of these, *D. kuntzi* was also reported from other rodents in Egypt including *A. dimidiatus*, *G. campestris*, *Rattus rattus alexandrinus* (Geoffroy), *Rattus rattus frugivorus* (Rafinesque), and *Mus musculus* Linnaeus (Myers et al., 1962; Rifaat et al., 1969a, b; Ashour and Lewis, 1982). Moreover, both *D. translucida* and *D. kuntzi* have also been redescribed by Piliitt and Wightman (1979) and by Ashour and Lewis (1982), respectively.

All of these nematodes are unusual oxyurids in being long and, apart from *D. translucida* and

Table 2. A comparison of morphology, microhabitat, and hosts of *Dentostomella tamimi* sp. n., *D. kuntzi*, *D. translucida*, *D. grundmanni*, and *D. legerae*.

Item	<i>D. tamimi</i> sp. n.	<i>D. kuntzi</i> Myers, 1961	<i>D. kuntzi</i> of Ashour and Lewis, 1982	<i>D. translucida</i> Shulz and Krepkogor- skaja, 1932	<i>D. grundmanni</i> Chitwood, 1963	<i>D. legerae</i> Quentin, 1975
Host	<i>Acomys dimidiatus</i>	<i>Acomys russatus</i> , <i>Aco- mys cahirinus</i>	<i>Acomys cahirinus</i>	<i>Rhombomys opimus</i>	<i>Eutamias quadrivittatus</i>	<i>Gerbillus campestris</i>
Microhabitat	Anterior 1/5 of small intestine	Large intestine	Anterior 1/5 of small intestine	Large intestine	Intestine	—
Cephalic inflation	Large	Large	Large	—	Small	Narrow and rounded
Mouth opening	Rounded	Rounded	Rounded	Triangular	Rounded	Rounded
Teeth per esophage- al sector	3 Unequal	3 Unequal	3 Equal	5	1	3 Unequal
Vulva to anterior extremity : fe- male body	1:2.1	1:2	1:2.2	1:2.3	1:1.9	1:2.1
Male caudal papillae	1 Pair	1 Pair	—	—	—	—
Preanal	1 Pair	1 Pair	1 Pair	1 Pair	1 Pair	1 Pair
Adanal	1 Pair + 1	2 Pairs + 1	2 Pairs + 1	2 Pairs + 1	3 Pairs	3 Pairs
Postanal	With irregular depres- sion	Simple	Simple	Simple	Simple	Simple
Spicule	Bifid	Simple, hooked	Simple, rounded	Bifid	Bidenticulate	Simple, rounded
Anterior end						
Distal end						

D. kuntzi, which were originally described from the large intestine (Schulz and Krepkogorskaja, 1932; Myers, 1961), in inhabiting mainly the small intestine, such as *D. grundmani*, *D. translucida*, and *D. kuntzi* (Rifaat et al., 1969 a, b; Pilitt and Wightman, 1979; Ashour and Lewis, 1982), or the stomach, such as *D. translucida* in hamsters (Greve, 1985).

Similar to the observations of Ashour and Lewis (1982) on *D. kuntzi*, *D. tamimi* sp. n. also prefers the anteriormost part of the small intestine. Both worms are long and slender, have a large cervical inflation, and can easily be separated from *D. translucida*, *D. grundmani*, and *D. legerae*, which are shorter, stout worms devoid of the large cervical inflation (Schulz and Krepkogorskaja, 1932; Myers, 1961; Myers et al., 1962; Chitwood, 1963; Quentin, 1975; Pilitt and Wightman, 1979; Ashour and Lewis, 1982; Greve, 1985). On the other hand, *D. tamimi* can be distinguished from *D. kuntzi* in being longer and thicker and in having a much larger cervical inflation that is constricted distally to appear as if there were 2 vesicles instead of only 1. It has a larger copulatory bursa and a longer esophagus and vagina vera, and its excretory pore lies at a shorter distance from the anterior end (Table 1). Moreover, *D. tamimi* has an arrowheadlike tail tip due to the presence of 2 ventrolateral protuberances that contain the phasmids. This characteristic is not found in any other *Dentostomella* species and together with the characteristically constricted large cervical vesicle, cannot only separate *D. tamimi* from *D. kuntzi*, but can distinguish this nematode from any other species in the genus. Furthermore, the spicule of both *D. tamimi* and *D. kuntzi* is also dissimilar. That of the former has an irregular depression on its anterior end and its posterior tip is bifid. Both ends of that of the latter are simple with the distal tip either rounded (Ashour and Lewis, 1982) or hooked (Myers, 1961) (Table 2). The number and arrangement of male caudal papillae are also different in both species. *Dentostomella tamimi* has 7 papillae, 1 pair preanal, 1 pair adanal, a single larger papilla just below the cloaca, and 1 pair postanal. The male of *D. kuntzi* described by Myers (1961) has 9 papillae, 1 pair preanal, 1 pair adanal, 3 postanal papillae on a raised elevation, and 1 pair below that elevation. That described by Ashour and Lewis (1982) has 7 papillae, but 5 of these are postanal and none are preanal (Table 2). The eggs are different in both

species too. Unlike that of *D. tamimi*, the egg of *D. kuntzi* is larger (Table 1) and operculated. Biologically, *D. tamimi* seems to prefer male hosts to female ones, while *D. kuntzi* infects both sexes equally (Ashour and Lewis, 1982).

Dentostomella tamimi is separated from *D. translucida*, *D. grundmani*, and *D. legerae*, which are stout, generally shorter worms devoid of a large, conspicuously constricted cervical vesicle. Moreover, the distinct arrowheadlike tail tip of *D. tamimi* is not found in any of these worms, nor is the irregular depression on the anterior end of the spicule. Similar to *D. tamimi*, the distal tip of the spicule of *D. translucida* is bifid, but that of *D. grundmani* is bidenticulate and that of *D. legerae* is simple and rounded (Table 2). The number and arrangement of male caudal papillae are also different in these worms. There are 7 papillae in *D. tamimi*, 1 pair of which is preanal. None of the other 3 species has preanal papillae. All have 1 pair of adanal papillae, but both *D. grundmani* and *D. legerae* have 3 pairs of postanal papillae and *D. translucida* only 5 postanal papillae (Table 2). The intestine of *D. tamimi* is as large as the esophagus (Figs. 1, 6), which is different from that of *D. translucida* and *D. grundmani*, whose intestine is much larger than the esophagus. Similar to both *D. kuntzi* and *D. legerae*, *D. tamimi* has 3 teeth per esophageal sector while *D. translucida* has 5 and *D. grundmani* only 1 (Table 2).

Acknowledgments

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